

## GREGARIOUS PARASITOIDISM IN AUSTRALIAN MUTILLIDAE (HYMENOPTERA)

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### Abstract

"*Ephutomorpha*" *ignita* (Smith) and "*E.*" *submetallescens* Turner develop gregariously on their mud-nesting hymenopterous hosts. The implications of this type of development in the biology of mutillids are briefly discussed.

### Introduction

Wasps of the family Mutillidae develop as parasitoids on the enclosed and inactive immature stages of other wasps, bees, flies, beetles, moths (Brothers, 1972) or cockroaches (Mickel, 1974). (The last host relationship is not proven since Mickel suggested that the mutillid was utilising an evaniid parasitoid of cockroach oothecae rather than developing directly on the cockroach eggs. He could find no evidence of evaniid exuvia in oothecae from which mutillids had emerged, however, and it does not seem to me necessary to postulate such a complicated relationship, particularly in view of the range of hosts previously recorded for Mutillidae.) In all cases thus far noted, each host specimen or "protein packet" has produced a single mutillid specimen, although the deposition of more than one egg on a single host is apparently not uncommon (Mickel, 1928; Brothers, 1972). Evidence of the development of more than one mutillid on a single host specimen in two closely related species of Australian Mutillidae is thus of considerable interest.

### Observations

During a recent visit to Australia, I discovered six female specimens of "*Ephutomorpha*" *ignita* (Smith) which had been reared from the cocoons of *Pison spinolae* Shuckard (Larridae), a mud nester, by E. F. Riek in 1950 (two females and three host cocoons) and 1952 (four females and one host cocoon). (Although the mutillids mentioned in this paper are referred to the genus *Ephutomorpha*, this is done merely for convenience and in accordance with past practice. They are actually members of one of the numerous new genera to be described for the Australian fauna.) This host relationship was confirmed by a further two females of "*E.*" *ignita* reared by E. McC. Callan in 1972. All specimens were collected in Canberra, A.C.T. Although such corroborated host records are of considerable interest *per se*, examination of the four host cocoons proved even more interesting. Each cocoon, about 13 to 15 mm long, has a hard and rather brittle wall and contains four cocoons of the mutillid. Three of the host cocoons (1950) had been opened artificially for investigation of the contents, and these contain dead mutillid larvae or pupae in addition to some empty mutillid cocoons. One such host cocoon had been opened when the mutillid larvae had barely started spinning, so that

it is impossible to be sure that it contained four mutillids, but such is my impression. The fourth host cocoon (1952) contains no dead mutillids and has a single exit hole of about 1.5 mm diameter in its anterior end, through which all four mutillids must have emerged. The mutillid cocoons are typical for the family, being thin-walled, papery and pale brown in colour. They are arranged somewhat irregularly in the host cocoon, but are more or less parallel to each other along the long axis of the host cocoon. Measurement of size is difficult, but the mutillid cocoons are approximately 7 to 9 mm long, and the associated females are all about 7 mm in length.

A second species, closely related to "*E.*" *ignita*, shows a similar relationship with its host. This is "*Ephutomorpha*" *submetallescens* Turner, which was reared from mud nests of *Abispa* sp. (Eumenidae) by H. Hacker in 1912 (four females and two males) and by E. C. Dahms in 1961 (three females and one male) and 1966 (five females). All of these specimens were collected in Brisbane, Queensland. Although no host remains have been preserved, Dahms informed me that more than one specimen had emerged from a single cell of the host, up to about four per cell. That four specimens may have emerged from one cell is further indicated by the fact that four of the five specimens from 1966 emerged on the same day. (Some of the specimens escaped during the course of experiments on sex attraction, however, and have not been preserved).

I have also examined two specimens, a male and a female, of an apparently undescribed species closely related to "*E.*" *ignita* and "*E.*" *submetallescens*. These specimens were reared from a single mud nest by T. F. Houston in 1964 in Adelaide, South Australia, and both emerged on the same day, but there is no indication as to whether they emerged from the same cell or not.

### Discussion

The above observations have led me to conclude that it is probable that the Australian mutillids comprising the group including "*E.*" *ignita* and "*E.*" *submetallescens* are parasitoids of mud nesting Hymenoptera, and that up to about four mutillids may develop on a single host individual.

The effects of such a situation of gregarious parasitoidism are varied. It means that a female need find fewer hosts for production of a certain number of offspring than must a female of a species which requires a different host individual for development of each mutillid. This must be particularly advantageous when individuals of the host are rare or widely dispersed. Despite this advantage, multiple parasitoidism in Mutillidae seems to be rare. Even mutillids which utilise mud nesting Hymenoptera elsewhere, such as species of *Dolichomutilla* and *Sphaerophthalma* (s.s.), do not produce more than one individual per host specimen (Brothers, pers. obs.). This rarity may be due to the behavioural characteristics of the mutillid larvae. Most previous work has indicated that mutillid larvae are very voracious, will consume all

available food, and will often even finish off a second (and even third) host individual if this is offered just before the first has been consumed (Brothers, 1972; Ferguson, 1962). The many instances where more than one egg is laid on a single host, and yet only one mutillid is produced, must involve the destruction of all but one of the eggs or larvae by the survivor, probably because of its voracity. This behaviour must be modified in gregarious parasitoids to enable the sibling larvae to coexist without attacking each other.

Gregarious parasitoidism must also have a marked influence on the size of the mutillids produced, since size is strongly affected by the amount of food consumed by the larva. Ferguson (1962) was able to produce particularly large specimens of two species of *Photopsis* by overfeeding, and Mickel (1924) showed that *Dasymutilla bioculata* (Cresson) had a bimodal size distribution because it was a parasitoid of two host species which differed in size. It is thus to be expected that the size of an individual mutillid of a species which is a gregarious parasitoid will be determined not only by the size of the host individual utilized, but also by the number of mutillid individuals developing on the host. Unfortunately, the material available to me is insufficient to indicate whether such a relationship actually holds or not. Sizes in the species involved do not seem to vary more than in other mutillids, but this may be because the number of mutillids produced per host individual is rather constant, or else because the number of mutillids produced per host may somehow be influenced by the size of the host.

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